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THE "BLOOD PICTURE" OF THE HORSE

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Recent advances in the biochemical and physiological aspects of animal diseases have revealed that the extent of variation which can occur in the constituents of the blood of farm animals without the appearance of any clinical signs of disease is wide and, indeed, the limits of such variation are still unknown. In the case of the horse this is especially true for, with the exception of one or two papers by American authors, veterinary literature contains few references to the blood picture of this animal. During the past few years a study of the "blood picture" of the horse has been made in connection with grass sickness, a disease of unknown aetiology, and the range and mean values of the important chemical constituents and physical characters have been established for normal horses. It was considered that it would be of interest to place on record these values obtained from 36 Clydesdale horses.

The 36 blood samples were obtained by visiting 24 farms in Aberdeenshire, not more than two horses being bled on any one farm. The horses had been lying out at pasture for three or four weeks but were in a state of active work during the day. At the time of bleeding the horses were either enjoying their rest at grass after a morning's work or were actually in the yoke.

Technique.

The methods used in the chemical analysis of the blood samples are too well known to need more amplification than the short description given below. In the case of the assay of the physical characteristics and cytology of the blood, however, the methods are described in more detail since in published papers, especially those relating to animal diseases, the variation in methods used by individual workers is so great that it was thought desirable to record the routine methods used at this Institute.

Blood was taken from the jugular vein by means of a 50 c.c. Record-type syringe. The syringe was withdrawn and 1 c.c. of blood was immediately expelled into a small Petri dish to provide blood for the coagulation test, and for the preparation of blood films. The remainder of the sample was distributed between a 30 c.c. bottle containing 80 mg. of a mixture of potassium oxalate and sodium fluoride in the ratio of 4 to 1 and a 20 c.c. bottle containing no anti-coagulant. These provided blood for chemical analysis. Part of the sample from the bottle containing oxalate and fluoride was used for the other physical tests.

Osgood (reported by McClung, 1937) has suggested that in examinations of oxalated blood samples the following time limits must be observed: Platelet count, 1 hour; fragility, 3 hours; sedimentation, 4 hours; red cell count, leucocyte count and haemoglobin estimation, 24 hours. Berg (1937), however, stated that the sedimentation rate if carried out on oxalated blood must be measured immediately and that 4 hours represents the time limit only for citrated blood.

In the results tabulated below, all estimations with the exception of the coagulation time were carried out the day after the blood sample was taken. Preliminary tests, in which samples were tested both within Osgood's time limits and also on the succeeding day, showed a wide variation in the sedimentation rate alone, and this measurement was not continued. The effect of the interval of 24 hours on the other results of the tests is discussed later in the paper.

CHEMICAL METHODS

Sugar was estimated by the Folin-Wu phosphomolybdate method; *Calcium* by the Kramer-Tisdall method; *Magnesium* by a modification of the Denis method; *Potassium* by the Kramer-Tisdall cobaltinitrite method; *Sodium* gravimetrically by means of uranium-zinc-acetate reagent after the method of Butler and Koltoff; *Inorganic and Total Phosphorus* by the Fiske and Subarrow methods; *Non-protein-nitrogen* by phosphoric-sulphuric acid digestion followed by Nesslerisation after the method of Folin-Wu; *Amino-nitrogen* by the β-naphthoquinone-sulphonic-acid colorimetric method; *Chlorides* by a modification of Volhard's method; *Haemoglobin* by the acid haematin estimated by a Newcomer glass standard method.

PHYSICAL AND CYTOLOGICAL METHODS

Coagulation Time.—This was measured by a modification of the capillary tube method, a little of the fresh blood from the small Petri dish being used. Two capillary tubes 30 mm. long and 1 mm. in diameter were used for each sample. The blood was quickly sucked up nearly to the top of the tubes, which were then held horizontally while the dry ends were plugged with plasticine. The tubes were placed, sealed ends downwards, in a wide-mouthed vacuum flask containing water at approximately 39° C. After three minutes a tube was withdrawn partially from the water and a small piece was broken off. It was again lowered into the warm water, the open end being held above the surface. This procedure was repeated each half-minute until a thread of fibrin was observed

between the broken ends. If one tube did not suffice the operation was continued on the second. The time which elapsed between the transfer of the blood to the Petri dish and the appearance of the fibrin thread was recorded as the coagulation time.

Smear for Differential Count.—After the coagulation tubes had been filled and placed in the vacuum flask a smear was prepared by Schilling's (1929) technique from a drop of blood from the Petri dish. The smear was subsequently counted according to Schilling's four-field meander method.

Platelet Count.—The method described by Ottenberg and Rosenthal (1917) was employed, in which the unstained platelets are counted after making the erythrocyte count. Saline was used as a diluent instead of 3 per cent. sodium citrate since an anticoagulant was already present. The technique appears to be open to a considerable degree of experimental error, but the method, though not accurate, is considered to be of use in demonstrating any gross change from the normal.

Erythrocyte Count.—All the blood samples counted were diluted to 1 : 200 with normal saline by means of the same Piney pipette. Two counts of 80 small squares of the haemocytometer were made from the same dilution, and where the error between the two counts was 10 per cent. or more, another drop was counted, and if less than 10 per cent. the mean was recorded.

Leucocyte Count.—Blood was diluted to 1 : 20 with 1 per cent. acetic acid and the cells counted in an area of 2 square mm. or more depending on the uniformity of distribution.

Viscosity.—A Denning-Watson viscosimeter was used—no correction was made for temperature.

Sedimentation Rate.—The apparatus described by Shufflebottom (1935) was used. Undiluted blood was drawn into the tubes, and the amount of sedimentation that had occurred after 15 minutes was recorded in centimetres.

Specific Gravity.—Two 500 c.c. amounts of stock fluids of known specific gravity were prepared by mixing benzol and chloroform. The specific gravity of the first was adjusted to give a hydrometer reading of 1,000 and that of the second to give one of 1,100. The stock fluids were stored in coloured, glass-stoppered bottles, and the specific gravity of their contents was checked, and if necessary adjusted, before use. The specific gravity of the blood was estimated by mixing simple proportions of these fluids in Wassermann tubes, and then adding a drop of blood. The specific gravity of the fluid in which the erythrocytes remained suspended for two minutes without accumulating at the top or bottom was determined by calculation and this figure was recorded as the specific gravity of the whole blood. The method has been checked by weighing.

Corpuscular Volume or Packed Cell Volume.—Two small haematocrit tubes containing blood were centrifuged at 4,000 r.p.m. for one hour, and the mean of the readings was recorded as the packed cell volume. Even after centrifuging for one hour, the difference in readings was sometimes as high as 10 per cent. of the red cell volume (*e.g.*, readings of 29 per cent. and 32 per cent.), and on one occasion amounted to 20 per cent.

Fragility of Erythrocytes.—A drop of oxalated blood was added to each of a series of tubes containing a different concentration of NaCl dissolved in distilled water. The lowest concentration was 0·35 per cent., the highest 0·55 per cent., and the variation in concentration between each tube 0·05 per cent. After the addition of the blood the tubes were inverted to ensure mixing, and left at room temperature overnight. The concentration of NaCl in the first tube in which complete haemolysis occurred was recorded as the fragility figure.

Indices.—The values used for the normal 100 per cent. for the purpose of computing the indices were as follows :—

Haemoglobin, 10 grammes per 100 c.c. ; erythrocytes, 7×10^6 per c.mm. ; packed cell volume, 30 per cent. erythrocytes.

The results of the analysis of the blood samples are recorded in Table I. (*See pages 160 and 161*).

Discussion of Results

Section " A."

It will be seen that the range for 36 horses is very wide for every chemical constituent examined, but that the distribution is such that the mode is easily obtainable. The average values for calcium, inorganic phosphorus and sodium agree very well with that reported by Robinson (1932) as the result of a survey carried out at Cambridge, but Robinson's average for potassium (29·33 mg.) is almost twice that of the authors' (16·5 mg.). Robinson's average is influenced considerably by the presence of several exceptionally high figures such as 62·05 mg., 68·86 mg., and 53·96 mg. Kintner and Holt (1932) examined the blood of 69 horses in the Philippine Islands and obtained the following ranges and averages : calcium ranged from 10·2 to 14·3 mg., average 11·2 mg. ; inorganic phosphorus from 2·63 to 5·00 mg., average 3·55 mg. ; magnesium from 1·33 to 2·45 mg. ; average 1·72 mg. ; chlorides from 363 to 495 mg., average 451 mg. ; sugar from 61 to 133 mg., average 92 mg. ; non-protein-nitrogen 21·0 to 36·0 mg., average 28·7 mg. ; and haemoglobin 56 to 104 per cent., average 80 per cent. ; the haemoglobin being calculated from the percentage of iron found in the blood. The values for the inorganic constituents are in close agreement with those of the authors considering the differing climatic conditions and rationing. The values for magnesium in Table I are distributed very evenly over the wide range and although the mode lies between 2·5 and 2·7 mg., quite a large percentage of the results are between 1·7 and 2·0 mg., which approximates to Kintner and Holt's average. The variation in the magnesium values could not be correlated with either change of state or difference in age. Pearson (1934) has shown that there is a high negative correlation between the age of the growing horse and the inorganic phosphorus content of the serum. The age groups used by this author ranged from one to four years. In the present investigation, the age of the animals ranged from two to twenty years. No significant correlation between age and phosphorus content of the blood was discernible although the values from many of the older horses were low. Holt and Reynolds (1924) found the ranges of the sugar, non-protein-nitrogen and haemoglobin of over 140 army horses in America to be as follows : sugar from 78 to 370 mg., average 109 mg. ; non-protein-nitrogen from 16·5 to 42·6 mg., average 25·82 mg. ; and haemoglobin from 70 per cent. to 98 per cent., average 88·2 per cent. The non-protein-nitrogen

content of the blood of the Aberdeenshire horses was much higher than either of the two series of American horses. This may be due to the horses grazing young pasture with a very high nitrogen content since the American horses were receiving stall rations of only an average protein content. Although the amino-nitrogen content of the blood of several of the horses possessing a high non-protein-nitrogen content is also high, *e.g.*, Nos. 313, 318 and 319, this is not invariably true, the amino-nitrogen values being for the most part round the mode of 6·0 to 7·0 mg. The mode for haemoglobin (9·0 to 9·5 grammes) is of the expected order but is considerably less than that of either of the American pairs of workers. The range of 8·1 to 11·1 grammes appears very wide for the haemoglobin content of normal horses but the American figures are in agreement with this wide variation. The sugar content of the blood was very constant but the average and mode were much less than that for the American horses. It is difficult to understand the high figures such as 370 mg. found by Holt and Reynolds. This must be much above the kidney threshold value for the horse which the present authors estimate at 180 to 200 mg. from urine and blood analysis carried out at this Institute.

Physical Properties and Cytology of the Blood

Erythrocyte Count.—The erythrocyte counts showed a very even distribution between 6·0 and $7·9 \times 10^6$, only three horses being outside this range. Horse No. 319 which showed the extremely high figure of 8×10^6 was a very excitable animal and several attempts to obtain its temperature proved in vain. Burnett (1917) reviewed the results of erythrocyte counts as recorded by 18 different authors and found the range of these results to vary from 5·4 to $10·3 \times 10^6$—a very wide range for normal animals. The averages recorded varied from 6·3 to $8·45 \times 10^6$, while the average for stallions alone was $9·4 \times 10^6$. Neser (1923) commenting on Burnett's review endeavoured to show that the blood count of a horse depended to a large extent on the animal's physical condition—stalled horses ranged from 3·9 to $7·0 \times 10^6$, horses doing fast work from 7·4 to $11·5 \times 10^6$ and racehorses from 9·0 to $11·0 \times 10^6$. He also showed that the count of samples obtained from the ear vein differed from samples obtained from the jugular vein and that this difference largely depended on the rate of circulation. An increased pulse rate caused by deliberately exciting an animal raised the erythrocyte count of samples from the jugular vein by nearly one million. This may account for the very high count in the case of No. 319.

Platelet Count.—As has been previously mentioned, the method used for enumeration is open to a high degree of error but it is of interest to note the variation obtained in 36 horses.

Coagulation Time.—The coagulation time varied between 4·5 and 12 minutes with a mode of 8 to 9 minutes. An exception was found in No. 326, in which case both capillary tubes had been completely broken up by the end of 17 minutes and the blood had not clotted. No reason can be offered for this delayed coagulation time. The calcium content of this blood sample was normal, being 11·5 mg.

Fragility and Specific Gravity.—The distribution round the modes of these properties was very regular. In the case of the fragility No. 302 provided the only exception with a value of 0·55 per cent. NaCl, while in the case of specific gravity Nos. 322 and 319, which had the lowest and highest erythrocyte count respectively, showed the lowest and highest specific gravity.

Packed Cell Volume and Volume Index.—From the tables it can be seen that the majority of cases show a corpuscular volume of 26 to 28 per cent., No. 319 being again an exception with a volume of 34 per cent. Neser (1923) suggested that the haematocrit readings were more reliable than the erythrocyte count and he established the relation between volume and count to be as follows :—

$$\frac{\textit{Packed cell volume}}{4·35} = \text{count in millions per c.mm.}$$

From the values obtained in the present investigation, the mean corpuscular volume would be approximately 4·0 as compared with the 4·35 suggested by Neser. The volume index of the majority of cases is less than 1·0 ; with one exception, however, the indices fell within a range of 0·8 to 1·04.

Colour Index and Saturation Index.—These indices are remarkable for their constancy, the colour index of the majority of cases falling between 0·9 and 1·04 and the saturation index between 0·95 and 1·14.

Viscosity.—With the exception of No. 319, which is again above the usual range, the viscosity varies from 4·4 to 6·8 times that of water. Authors quoted by Wirth (1931) give ranges below these figures with limits of 3·3 and 5·7.

Leucocytes.—The leucocytic count showed a fairly even distribution between 6,600 and 11,800, the only exception being case 319, which exceeded this range with a count of 12,400.

The percentage of neutrophil cells varied from 36 per cent. to 72 per cent., with the exception of horse No. 322 at 81 per cent.

The mode lay between 45 and 69 per cent.

Cooke and Ponder (1927) defined a segmented neutrophil cell as one in which only a fine filament of nuclear material united the different lobes of the nucleus. According to this definition 16 to 50 per cent. of leucocytes were non-segmented neutrophils, the average being 25 per cent. The segmented forms ranged between 15 and 46 per cent., with a mean of 27 per cent.

In some horses, the non-segmented forms were in the majority.

Many non-segmented forms showed coarsely lobulated nuclei ; these appeared to be adult cells and not true metamyelocytes. Such forms are shown in Fig. 1 (*See page 162*).

A few non-segmented cells showed simple, band-like nuclei, and these were accepted as being " Band form " metamyelocytes. The distinction between these two types of cells is to a certain degree subjective and hence an example of the type of cells accepted as " band " metamyelocytes is given in Fig. 2 (*See page 162*).

Band forms of this type ranged from 0·5 to 8 per cent. of the leucocytic count, with a mean of 3 per cent. and a mode between 1 and 5 per cent. This agrees with the majority of workers quoted by Wirth (1931).

Lymphocytes.—The percentage lymphocytes ranged from 13 per cent. to 56 per cent. with the mode at 25 per cent. to 29 per cent. The absolute count varied between 1,200 and 5,300 with 28 out of the 36 cases falling between 1,500 and 3,400 per c.mm.

TABLE I

No.	State.	Age.	Pulse Rate.	Temp.	Resp.	Counts.			Haemogram.						Physical	
									Neutrophils.							
						Red. Millions.	White.	Platelets. Thousands.	Band.	Poly-morphs.	Lymphocytes.	Monocytes.	Eosinophils.	Basophils.	Coagulation Time. Minutes.	Fragility. Per cent. NaCl.
		Years.		°F.												
301	Grazing	4	58	100	28	7·4	9,000	190	5	43	38	6	8	—	7·0	0·5
302	„	3	60	100·6	28	6·7	9,000	150	3	34	56	3	4	—	6·5	0·55
303	Working	4	46	100	20	6·6	8,000	170	2	56	29	7	5	1	7·0	0·4
304	„	8	40	100	12	6·7	7,600	140	4	52	31	7	6	—	11·0	0·45
305	„	4	60	99·6	16	6·6	9,000	160	4	45	40	7	3	1	8·0	0·4
306	Grazing	15	58	99·8	32	7·2	9,400	120	8	61	23	1	7	—	8·5	0·45
307	„	20	40	98·8	20	6·9	8,600	90	3	53	29	5	10	—	9·5	0·45
308	Working	12	42	99·6	18	7·1	8,200	150	4	63	19	6	8	—	8·5	0·45
309	„	4	44	101	18	7·2	8,000	260	6	38	41	5	10	—	7·5	0·4
310	„	7	52	100·4	20	7·9	9,200	100	2	59	18	8	12	1	8·0	0·4
311	Grazing	3	56	100·4	24	7·3	10,600	100	1	43	47	6	3	—	4·5	0·5
312	„	7	52	100	28	6·8	6,800	120	0·5	47·5	44	4	4	—	8·5	0·4
313	„	8	64	100	20	6·3	8,400	340	5	40	35	6	14	—	6·0	0·45
314	„	6	60	99·8	24	6·2	6,800	140	5	58	22	6	8	1	9·0	0·50
315	Grazing	3	56	100·4	24	7·1	8,800	270	5	46	28	2	13	—	7·5	0·45
316	Working	3	40	101·4	20	7·5	9,000	140	2	36	47	7	8	—	5·5	0·45
317	„	10?	46	100	22	7·0	11,200	160	1	53	14	3	28	1	6·0	0·50
318	Grazing	8	44	99	24	6·3	8,000	190	2	65	25	4	4	—	5·0	0·45
319	„	4	64	excited	24	8·8	12,400	410	1	42	43	5	8	1	8·0	0·45
320	„	8	56	100	24	6·3	8,600	330	2	54	29	6	9	—	—	0·45
321	„	10	54	99·6	14	6·8	6,900	360	4	59	24	3	7	3	—	0·45
322	„	Old	48	100	14	5·7	9,400	200	3	78	13	2	2	2	—	0·50
323	„	8	56	99·8	26	7·5	9,200	170	1	52	26	6	12	3	7·0	0·45
324	„	4	52	99·6	20	7·1	8,600	320	0·5	42·5	39	6	12	—	5·0	0·45
325	„	3	56	100·6	16	7·2	11,800	190	1	46	35	6	12	—	7·5	0·50
326	Working	6	56	100·6	20	6·5	7,800	150	0·5	58·5	32	6	3	—	Over 17	0·45
327	„	11	48	98·4	16	6·2	6,600	220	1	53	25	6	14	1	5·0	0·50
328	„	20	56	98·0	20	6·9	9,200	190	6·5	65·5	16	3	9	—	10·0	0·40
329	Grazing	10	56	100	16	7·8	7,200	150	1	65	27	5	1	1	6·5	0·40
330	„	Over 8	54	99·4	16	7·0	9,800	150	4	48	33	5	8	2	10·0	0·50
331	„	11	56	99·8	20	6·8	7,600	300	3	43	34	8	12	—	12·0	0·45
332	„	11	60	99·8	20	6·1	6,600	230	1·5	34·5	48	8	7	1	11·0	0·45
333	Working	4	56	100	16	8·2	10,400	190	4	58	32	1	5	—	8·0	0·45
334	Grazing	2	44	101·4	20	7·6	11,000	580	3	38	44	5	10	—	6·0	0·50
335	„	Aged	56	99·4	20	7·2	10,200	280	4	64	26	3	3	—	7·0	0·45
336	„	7	64	100·2	20	6·6	8,600	100	5	61	25	2	7	—	6·5	0·50
Range	—	—	40/ 64	98/ 101·4	12/ 32	5·7/ 8·8	6,600/ 12,400	90/ 410	0·5/ 8	34/ 78	13/ 56	1/ 8	1/ 28	0/ 3	4·5/ Over 17	0·4/ 0·55
Mean	—	—	53	100	20	6·95	8,800	210	3	52	31·5	5	8	0·5	8	0·45
Mode	—	—	55	100	20	6·5/ 6·9	8,000/ 9,900	140/ 150	1/5	50/ 59	25/ 29	6	8	0	8/ 8·5	0·45

Monocytes.—The percentage counts for monocytes varied from 1 per cent. to 8 per cent. with a mode at 6 per cent. The absolute count varied from 100 to 700 per c.mm. with the mode of 500. The lympho-cyte-monocyte ratio varied from 44 : 1 in case No. 334 to 18 : 8 in case No. 310.

Eosinophils.—The percentage count of eosinophils varied from 1 per cent. in No. 329 to 28 per cent. in No. 317; this latter horse appears exceptional, since

Table I

Properties.			Indices.			Chemical Constituents.										
						Mg. per 100 c.c. of Blood.							Mg. per 100 c.c. of Serum.			
Sp. Gr.	Packed Cell Vol. Per cent.	Viscosity. Cp. to Water.	Colour.	Volume.	Saturation.	Sugar.	Hb. $\times 10^{-3}$	Cl.	Inorg. P.	Total P.	N.P.N.	Amino-N.	Ca.	K.	Na.	Mg.
1052	28	5·7	0·80	0·89	1·01	95·2	9·5	430	4·78	22·47	42·8	6·66	13·5	11·7	306	3·11
1052	27	5·4	1·00	0·95	1·02	65·6	9·3	450	5·64	26·70	50·0	5·95	12·5	15·0	316	2·98
1050	27	4·4	0·97	0·97	0·99	80·6	9·0	450	3·20	17·04	40·5	6·22	12·0	14·3	306	2·09
1050	24	4·7	0·95	0·85	1·10	68·0	9·0	460	3·84	17·86	39·2	6·52	11·9	15·0	310	2·55
1050	26	4·5	0·99	0·92	1·04	69·0	9·1	470	4·12	19·24	45·5	5·93	12·2	15·8	307	2·67
1055	27	5·3	0·95	0·87	1·07	62·5	9·7	460	3·18	19·14	45·5	6·66	13·1	15·6	312	2·65
1055	28	4·8	1·03	0·95	1·08	77·5	10·2	470	2·62	20·32	50·9	5·98	13·2	15·9	309	2·82
1055	28	5·9	1·00	0·91	1·07	85·1	10·1	470	2·96	17·08	46·1	6·00	11·8	15·9	312	2·57
1057	30	6·5	1·03	0·98	1·04	87·3	10·4	440	—	—	48·4	7·11	12·6	16·3	317	2·77
1057	30	6·2	0·94	0·89	1·04	67·8	10·4	460	—	—	46·9	6·52	12·4	17·0	314	2·57
1055	27	6·1	0·97	0·86	1·10	88·9	10·0	470	5·22	23·10	51·3	10·75	12·2	27·4	313	2·65
1052	25	4·6	0·96	0·84	1·10	67·8	9·3	470	3·42	19·52	40·8	7·00	13·0	26·3	316	2·30
1055	28	5·9	1·08	1·03	1·03	74·1	9·7	480	3·34	18·87	59·4	11·20	12·4	23·4	322	2·57
1052	26	4·7	1·01	0·98	1·03	56·5	9·0	440	3·48	18·97	37·3	6·32	12·6	17·3	313	2·84
1052	27	5·3	0·97	0·88	1·07	69·0	9·7	450	4·12	20·00	37·1	6·60	12·2	13·8	341	2·35
1052	31	6·8	0·95	0·97	0·99	67·8	10·2	450	5·20	22·47	54·5	7·45	11·4	13·4	319	1·78
1052	29	6·7	1·00	0·96	1·02	54·0	9·9	450	4·44	22·35	49·2	6·66	11·5	15·9	317	1·93
1052	28	4·7	1·05	1·02	1·02	76·9	9·6	470	3·28	21·75	58·3	12·50	9·7	16·9	311	1·73
1060	34	8·5	0·87	0·90	0·96	68·5	10·9	450	4·18	23·83	55·6	9·93	12·5	18·4	318	1·73
1052	27	5·1	1·00	1·00	0·99	79·0	9·0	460	2·98	18·62	46·1	6·01	11·7	14·1	305	1·75
1055	29	5·6	1·02	1·01	1·02	72·7	9·8	460	2·96	20·32	50·4	7·79	11·6	17·9	316	1·85
1047	25	4·4	1·00	1·03	0·96	80·0	8·1	500	2·20	16·34	50·0	6·19	16·5	17·5	319	1·74
1052	32	5·7	0·90	1·00	0·89	85·1	9·5	460	2·64	18·45	39·5	7·09	12·5	13·7	—	1·93
1052	26	5·3	0·89	0·85	1·02	78·4	9·0	470	3·26	19·81	34·3	5·95	12·6	17·7	311	2·46
1052	27	5·0	0·92	0·87	1·03	72·7	9·4	440	2·90	21·65	30·8	7·57	12·4	16·9	315	2·34
1055	26	5·7	1·01	0·92	1·07	72·7	9·3	470	4·36	20·85	40·8	5·90	11·5	12·9	329	2·13
1052	26	4·4	1·00	0·98	1·01	85·8	8·8	460	3·64	19·61	37·5	6·22	11·4	14·2	316	1·99
1055	27	5·5	0·91	0·91	0·98	75·5	8·9	470	2·64	20·21	35·7	6·60	12·3	14·1	311	2·01
1057	26	5·6	0·82	0·77	1·04	69·0	9·1	460	4·00	19·72	42·8	10·75	12·0	14·8	330	2·16
1057	28	6·4	0·94	0·93	1·00	74·1	9·4	470	3·62	21·18	33·7	7·79	13·2	15·9	329	2·82
1055	29	4·9	0·97	1·00	0·94	66·2	9·4	450	3·36	19·14	33·2	6·70	—	—	—	—
1052	27	4·4	1·00	1·02	0·98	72·4	8·8	480	3·36	19·33	38·7	6·42	—	—	320	—
1057	30	5·9	0·95	1·85	1·11	72·7	11·1	450	4·16	22·47	40·3	6·38	11·7	17·5	321	2·01
1052	26	4·5	0·90	0·80	1·09	73·3	9·6	460	4·56	22·23	38·0	6·09	12·1	16·5	323	2·03
1055	28	5·7	1·05	0·91	1·14	67·1	10·7	470	2·80	19·24	37·5	5·74	12·3	15·6	320	2·65
1050	26	4·4	0·97	0·92	1·04	76·9	9·1	450	3·30	20·21	38·0	6·23	12·2	15·9	330	2·67
1047/	24/	4·4/	0·82/	0·77/	0·89/	54·0/	8·1/	430/	2·20/	16·34/	30·8/	5·74/	9·7/	11·7/	305/	1·73/
1060	34	8·5	1·08	1·03	1·11	95·2	11·1	500	5·64	26·70	59·4	12·50	16·5	27·4	341	3·11
1050/	27/	5·4	0·96	0·93	1·03	72·1	9·55	462	3·64	20·29	43·5	7·15	12·3	16·5	317	2·33
55	28															
1050/	27	5·5/	1·00/	1·00/	1·00/	65·0/	9·0/	460/	3·0/	17·5/	35·0/	6·0/	12·0/	15·0/	310/	2·50/
55		5·9	1·04	1·04	1·04	70·0	9·5	480	4·0	22·5	40·0	7·0	13·0	17·0	320	2·70

the range of the other cases does not exceed 14 per cent. The absolute count varied from 100 to 3,100 per c.mm., No. 317 again being exceptional, the next highest being only 1,400. Thirty-two out of the 36 cases ranged between 200 and 1,100 per c.mm.

Basophils.—Three horses showed 3 per cent' basophils, three 2 per cent. and nine 1 per cent. No basophils were seen in the 100 cells counted in each of the other 21 cases. The absolute range varied from 0·0 to 300 cells per c.mm.

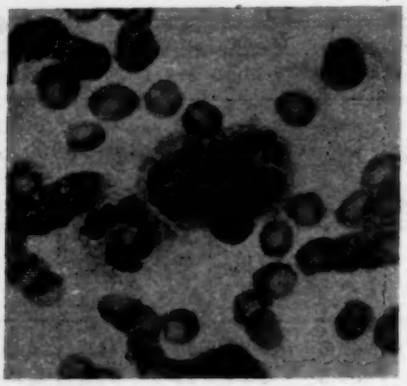

Fig. 1.
Type of cell designated as an unsegmented adult neutrophil.

Fig. 2.
Type of cell designated as a neutrophilic band metamyelocyte.

Table II

No.	Breed.	Weight. Lbs.	Pulse Rate.	Temp. °F.	Resp.	Counts. Red. Millions.	Counts. White.	Counts. Platelets. Thousands.	Haemogram. Neutrophilic Cells. Band.	Haemogram. Neutrophilic Cells. Polymorphs.	Haemogram. Lymphocytes.	Haemogram. Monocytes.	Haemogram. Eosinophils.	Haemogram. Basophils.	Physical Coagulation Time. Minutes.	Physical Fragility. Per cent. NaCl.	Sp. Gr.
402	Vanner ...	870	—	—	—	7·8	9,400	220	4	70	18	5	3	0	5·0	0·50	1055
403	Cart horse	1,138	—	—	—	7·0	10,400	190	2	64	28	2	4	0	9·5	0·45	1055
404	Shetland	304	—	—	—	7·1	11,200	180	2	54	38	1	5	0	4·0	0·50	1052
405	Vanner ...	934	—	—	—	6·2	9,300	200	3	64	27	4	—	0	5·5	0·50	1050
406	Hunter ...	829	—	—	—	6·7	7,000	300	4	61	18	3	14	0	8·0	0·45	1045
407	„ ...	948	—	—	—	7·3	7,700	110	5	46	42	3	3	1	7·0	0·50	1052
408	Shetland	408	—	—	—	6·7	7,800	220	2	55	32	5	4	2	5·0	0·45	1052
409	Pony ...	404	—	—	—	5·7	5,000	160	1	42	54	1	2	0	4·0	0·45	1050
414	Vanner ...	971	—	—	—	7·9	9,100	140	—	63	26	2	9	0	8·0	0·45	1055
415	„ ...	925	—	—	—	7·0	7,300	140	—	54	38	5	3	0	9·0	0·50	1055
203	Clydesdale	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
204	Pony ...	—	36	100	7	9·3	10,800	160	—	56	33	9	2	0	4·0	0·40	1055
205	Clydesdale	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
206	„	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
207	„	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
209	„	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
210	„	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
211	„	—	46	101·6	16	6·3	12,000	260	2	76	15	3	4	0	4·0	0·45	1050
212	„	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
213	„	—	60	101·1	16	6·6	10,900	110	—	60	27	7	6	0	3·5	0·45	1052
215	„	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
216	„	—	44	99·8	10	9·4	9,900	150	6	78	9	4	2	1	4·0	0·40	1065
218	„	—	70	101·6	9	8·8	17,000	180	5	81	7	6	1	0	8·0	0·45	1070
219	„	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
220	„	—	54	101·2	14	7·3	12,000	110	—	46	31	2	18	3	7·0	0·45	1050
221	„	—	40	99·5	24	7·4	9,300	110	7	36	23	3	10	1	8·0	0·45	1060
Range	—	—	36/ 70	99·8/ 101·6	7/ 24	5·7/ 9·4	5,000/ 17,000	110/ 300	0/7	42/ 81	7/54	1/10	0/22	0/3	3·5/ 9·5	0·4/ 0·5	1045/ 1070
Mean	—	—	50	100·7	14	7·3	9,800	176	2·5	59	27	3·5	5	1·5	6·0	0·45	1055
Mode	—	—	7 animals	7 animals	7 animals	7/ 7·4	9,000/ 9,900	160/ 190	1/4	60/ 64	25/ 29	3	2/4	0	8/8·5	0·45	1055

General Discussion.

The chief point of interest in the above tabulated data and observations thereon is the outstanding fact that one or two horses are responsible for the extreme values of the ranges of most of the chemical constituents. Whereas the blood of No. 322 had the lowest haemoglobin and magnesium content and the highest calcium and chloride content, the blood of No. 301 had the highest sugar and magnesium content and the lowest sodium, potassium and chloride content. Despite the apparent abnormality of these blood samples, the horses by all clinical measurements were seemingly normal yet it would appear that a physiological mechanism was upset to some extent. This illustrates very well the difficulties to be surmounted in the classification of animals into normal and abnormal by blood pictures *per se*, especially when several constituents are at the maximum and minimum of what is accepted as the normal range. On the other hand, it is interesting to study No. 319. As has already been mentioned, this horse became excited previous to being bled and the sample taken then marks the extreme range for the erythrocyte count, the leucocyte count, the packed cell volume and the viscosity, all these measurements being functions of the cellular concentration. The differential count, biochemical estimations and the other physical findings were well within the normal ranges. This substantiation of Neser's theory that erythrocyte count is dependent to a large extent on the rate of circulation introduces yet another difficulty in the interpretation of blood assays.

The ranges for the physical properties are similar to those given by other workers as reviewed by Wirth (1931). These limits include the following. Maximum resistance of erythrocytes, 0·40/49 (average 0·44), this is slightly under our figure for fragility; specific gravity 1039/1058; packed cell volume 24·2/40·75.

Table II.

Properties.				Indices.			Chemical Constituents.										
							Mg. per 100 c.c. of Blood.							Mg. per 100 c.c. of Serum.			
Sp. Gr.	Packed Cell Vol. Per cent.	Viscosity. Cp. to Water.	Sedimentation.	Colour.	Volume.	Saturation.	Sugar.	Hb. $\times 10^{-3}$	Cl.	Inorg. P.	Total P.	N.P.N.	Amino-N.	Ca.	K.	Na.	Mg.
1055	28	5·8	5·3	0·86	0·83	1·01	76·3	9·6	500	—	—	35·3	8·2	12·66	18·2	—	2·61
1055	26	5·8	2·5	0·90	0·86	1·04	90·9	9·1	480	3·34	21·65	33·2	9·3	11·46	17·8	—	2·49
1052	28	5·8	2·7	0·95	0·91	1·00	122·7	9·5	460	3·06	17·32	30·0	8·7	13·33	17·3	—	2·13
1050	28	5·4	8·0	1·10	1·05	0·96	87·3	8·9	480	2·64	15·52	33·5	9·2	14·26	17·3	—	2·18
1045	28	5·7	5·5	1·00	0·98	0·98	84·4	9·3	480	3·41	15·94	32·4	9·6	12·66	17·1	—	2·26
1052	34	5·9	3·3	0·98	1·10	0·90	86·6	10·2	440	1·74	15·82	33·2	8·0	12·40	14·3	—	2·72
1052	33	6·4	6·2	1·05	1·18	0·91	85·1	10·0	440	2·76	21·18	23·5	7·5	12·53	16·0	—	2·26
1050	28	6·5	7·5	1·07	1·20	0·92	104·7	8·5	490	3·12	18·80	28·8	8·7	11·06	14·5	—	2·53
1055	29	7·2	3·5	0·92	0·86	1·05	64·1	10·2	480	2·64	21·18	38·2	12·0	12·66	25·7	—	2·24
1055	35	6·2	1·3	1·25	1·18	1·06	93·0	12·4	470	3·78	23·55	40·0	9·2	12·93	13·0	—	2·70
—	—	—	—	—	—	—	97·6	13·6	460	—	25·60	37·5	14·0	11·70	26·4	316	—
1055	35	10·0	2·5	1·04	0·88	1·18	104·7	14·5	450	—	19·60	29·5	17·5	12·0	27·5	323	—
—	—	—	—	—	—	—	96·6	11·0	480	—	21·10	28·5	10·8	12·4	22·6	309	—
—	—	—	—	—	—	—	85·1	9·3	460	—	17·20	27·5	7·8	11·7	16·6	313	—
—	—	—	—	—	—	—	79·7	11·3	470	—	20·00	28·5	8·3	12·5	16·9	319	—
—	—	—	—	—	—	—	79·0	13·9	480	—	29·60	46·0	8·8	12·7	20·1	306	—
—	—	—	—	—	—	—	78·4	11·6	470	—	38·80	40·0	8·0	12·5	17·5	306	—
1050	27	3·8	1·0	1·20	1·00	1·17	80·0	10·6	460	—	41·20	31·5	5·3	11·8	19·4	313	—
—	—	—	—	—	—	—	97·1	11·8	450	—	19·00	32·5	5·4	12·0	16·6	309	—
1052	28	7·0	1·1	1·10	1·00	1·08	71·4	10·2	460	—	19·80	48·0	4·3	11·2	15·1	309	—
—	—	—	—	—	—	—	76·9	12·7	480	—	43·50	35·0	8·0	11·8	15·3	316	—
1065	40	9·0	1·5	1·23	1·00	1·25	70·9	16·1	440	—	25·30	41·5	8·0	12·5	16·0	323	—
1070	35	5·0	4·8	1·25	0·92	1·32	97·6	15·3	470	—	23·90	43·0	8·8	12·4	17·5	326	—
—	—	—	—	—	—	—	80·0	10·6	460	—	34·20	33·5	3·8	11·7	19·7	341	—
1050	30	5·5	6·5	1·16	0·95	1·20	96·6	12·0	450	—	20·62	54·5	11·2	11·8	19·8	300	—
1060	27	4·8	2·6	1·15	0·85	1·30	71·4	11·8	500	2·78	20·40	30·2	6·0	12·93	—	—	2·15
1045/	26/	4·8/	1·0/	0·86/	0·83/	0·90/	64·1/	8·5/	440/	1·74/	15·52/	23·5/	3·8/	11·06/	13·0/	300/	2·13/
1070	40	10	8	1·25	1·20	1·32	122·7	16·1	500	3·78	43·50	54·5	17·5	14·26	27·5	341	2·72
1055	30	6·2	3·9	1·07	0·98	1·08	86·8	11·3	467	2·92	23·63	35·2	8·7	12·29	18·3	315	2·38
1055	28	5·5/	1·0/	0·90/	0·85/	1·05/	75/	11·5	460/	3·0/	20·0/	30·0/	8·0/	12·0/	15·0/	300/	2·1/
		5·9	2·9	1·29	1·04	1·09	80	12·0	480	4·0	22·5	35·0	9·0	13·0	19·0	310	2·3

The various types of cells are within the limits set by other workers, with the exception of the eosinophil cells in which our figures are above those recorded. Our percentage of monocytes is also high in comparison to some workers.

Wirth records that females have a smaller red count and haemoglobin content than males, while geldings give counts falling between the mare and the stallion; no figures are given. In this investigation we did not distinguish between mares and geldings.

The need for much more intensive work on the blood of animals before blood pictures can serve a useful purpose as an aid to diagnosis of disease is obvious.

Section "B."

The cost of obtaining horses for experimental purposes by Research Institutes is very high and it is usual in these circumstances to buy animals which would normally have been bought only by knackeries for slaughter. Since these horses are for the most part either extremely aged or suffering from a disabling condition it is of interest to compare their blood picture with that of the active healthy horses of the previous section. In Table II (*See pages 162 and 163*). are to be found the blood pictures of several horses bought by this Institute and used for experimental purposes during the past few years. In the table, Nos. 407 to 415 were bought in the Edinburgh district whereas Nos. 203 to 221 were obtained in Aberdeenshire, the same district as those in Table I. The blood picture is not complete in every case since there were assayed only those constituents which had some bearing on the experiment for which the horses were being used. During experiment the horses were kept in stables and fed an artificial ration. The blood samples were all obtained prior to placing the animals on experiment.

It will be seen from Table II that the ranges of many of the chemical constituents are much wider than those observed in Table I. In many cases, however, despite the wider range both the means and the modes show excellent agreement. Nutritional differences such as the feeding of dry foodstuffs compared with luxuriant pasture-grass might be expected to influence the blood picture to a slight degree. It is only in the case of haemoglobin that the variation becomes significant—the higher limit of the range is increased from 11·10 to 16·10 grammes, the mean from 9·55 to 11·3 grammes and a mode of 9·0 to 9·5 grammes in the case of Table I becomes one of 11·5 to 12·0 grammes in Table II. This value for haemoglobin is similar to that found by Kintner and Holt and Holt and Reynolds. It would appear also that horses of the type described in Table II have a tendency to a higher blood sugar than those in full strength and vigour seen in Table I, although with regard to increases in the sugar content of the blood nutrition might well be a factor. It can also be observed that the non-protein-nitrogen content of the blood of the stall-fed horses is slightly less than that of those at grass. The remarkable consistency of the values for the mineral constituents of the blood of both groups is worthy of notice. Although the ranges are slightly different, the means and modes are most constant.

Examination of the leucocytic picture and the values for the physical properties of the blood of the two groups reveals that although the ranges may be wider the modes are similar. In the case of the horses of Table I, it has already been noted that the platelet count and fragility estimation were carried out 24 hours after the samples had been taken, whereas in the case of those in the second group the time limits suggested by Osgood were observed—namely, 1 hour and 3 hours respectively. It will be seen that the range of the platelet count of the horses of Table I is similar in distribution to that of the horses of Table II, and that the maximum limit of Table I is higher than that of Table II, of which the enumeration was carried out within Osgood's time limits. With regard to the fragility the distribution of both groups showed the same range and mode, with one exception, No. 302 of the first group. The delay in testing, therefore, which occurred in the case of the horses in Table I would appear to have made little or no difference to the results. Moreover, the small variation in the case of the colour index, the saturation index and the volume index would suggest that little alteration had occurred from haemolysis or shrinkage during the time which elapsed —approximately 24 hours after sampling—before the blood from the horses in Table I was assayed. Field work usually necessitates rather long intervals between the collection of the blood samples and their assay. The technique employed and described in the previous section of this paper allows of the assay (with the exception of the measurement of the sedimentation rate and the coagulation time) being carried out 24 hours after sampling without any significant error being introduced.

The sedimentation rate, giving a mean of 3·9 cm. fall in 15 minutes is in close agreement with the work of Zott as recorded by Wirth (1931).

Since the animals of the second group had been stabled for several days before blood was collected and were not in hard physical condition, the slightly lower proportion of metamyelocytes was to be expected. Forty blood films from these horses (no individual horse being bled twice on the same day) gave a range of from 0·0 per cent. to 9·0 per cent. band forms. Another interesting finding was that 6 out of the 17 horses showed a coagulation time below the range found in Table I.

As will be seen from Table II the erythrocyte counts and packed cell volumes are markedly higher than those of Table I. This corresponds with the higher haemoglobin values previously commented upon. Whether the state of activity or the diet is the essential factor in causing this significant difference between the two groups is uncertain from the available data. It is obvious, however, that before such horses are placed on experiments in which blood changes are to be recorded care should be taken to establish their usual blood picture by several bleedings at varying intervals before the start of the experiment in order that the results are not masked by such factors as slight changes in the state of activity or diet.

Summary

The range, average and mode of the constituents of the blood of 36 Clydesdale horses are recorded.

The usefulness of aged and disabled horses for experiments in which blood records are to be kept is discussed.

Note.—We are indebted to Mr. G. R. Knight for the photographs.

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"PROCESSING" SURPLUS POTATOES

The Ministry of Food have just announced a scheme for building factories to process surplus potatoes, and it is understood that one of the chief objects of the processing will be to increase the supply of animal feeding stuffs. In this connection, *The Times* observes: "The contributions which the livestock, pig, and poultry industries can make to the nation's food supply is immense, and there are clear indications that it must not be allowed to decline. For home-killed meat is expected to provide under the rationing scheme a higher percentage than usual of total supplies, and home production will be responsible for providing much of the supply of unrationed meat. No doubt considerable efforts have been made to improve the supply of feeding stuffs, and on an average the Minister of Food's pledge that 66 per cent. of normal supplies would be available may well be fulfilled; but it is reported that supplies are still very short in some areas, and certainly below the promised proportion of normal requirements. Any step which reflects a long-term view of the problem of ensuring a full supply of these feeding stuffs is therefore welcome. Another welcome feature of the scheme is that it promises to eliminate one kind of waste. . . . . The Ministry of Supply have undertaken a campaign to induce more local authorities to undertake the systematic collection of waste paper. The Ministry of Food might well undertake a similar campaign to organise the fullest possible use of the refuse falling within their province. It is one of the virtues of rationing that it is a powerful incentive to avoid the waste of food fit for human consumption, but a corollary to rationing is that food fit for animals should not be wasted any more than food fit for human beings."

* * * * *

A Reuter message from Johannesburg (quoted by the *Meat Trades Journal*) says: To counteract the blowfly menace to sheep, Mr. S. M. Venter, a prominent farmer, is breeding vultures, it is reported from Bronkhorstspruit, Transvaal. There are very few vultures left in the district and the blowfly has become troublesome. Reports that vultures attack lambs are discounted by Mr. Venter. He believes that when a vulture is seen beside a lamb, it is only to feed upon the blowflies with which the animal has become infested. Mr. Venter wants a flock of 20 tame vultures to keep his sheep clean and he is rearing the birds from the egg in an incubator.

THE VETERINARY RECORD
March 2nd, 1940

THE "BLOOD PICTURE" OF THE HORSE

HAEMATOLOGY may now be said to be an important part of human medicine, and haematological studies are included in the routine investigation of patients admitted to hospital. The immense amount of information gained from these investigations has materially widened the concepts of human pathology and medicine. On the experimental side of haematology the advances have been steady and at times almost spectacular. One of the most inspiring chapters in the history of medicine consists of the story of the curative effect of liver in pernicious anaemia in man. Castle and his colleagues showed that the deficiency in pernicious anaemia was due to the absence of two factors, the intrinsic factor present in the gastric juice and an extrinsic factor in the protein of food. These two factors react together to form the factor present in liver, the curative effect of which had been so amply demonstrated by Minot and Murphy. Further work showed that the reticulocytes, the immediate precursors of the red blood corpuscles, respond in such a definite way to specific treatment that the reticulocyte response is now used to test the potency of liver extracts. The present position is that it is extremely rare for an acute case of pernicious anaemia in man to die and yet previous to 1926 the mortality rate in this disease was nearly 100 per cent.

For various reasons veterinary haematology has not advanced to the same extent as medical haematology. Economic reasons will probably always weigh against extensive routine investigations of the blood of individual cases. Nevertheless the simple enumeration of the red and white blood corpuscles alone may yield valuable information which will be of aid in making a diagnosis. The presence of a leucocytosis may justify one in the suspicion of acute inflammation of some internal organ, the presence of eosinophilia of intestinal parasitism, whilst a hypochromic anaemia may be indicative of a dietary deficiency. The haematological approach to certain veterinary research problems has yielded important results and it could be more extensively applied. In their investigation of enzootic marasmus in sheep in Australia, Filmer and Underwood demonstrated the importance of cobalt as a trace element and showed that as far as sheep are concerned cobalt is necessary for normal haemopoiesis. Although the blood picture may throw no direct light on the aetiology of a condition the state of the blood may amplify the pathology of the disease. This is the case in grass sickness in horses, and Holman in an article shortly to be published in this journal shows that the haematological findings confirm the opinion that this process is one of anhydraemia.

One of the greatest needs of veterinary haematology is some further extension of our knowledge of normal standards. There is a lack of adequate information in English veterinary literature on what constitutes the normal blood picture in the domesticated animals. Wirth of Vienna has amassed a considerable amount of information from the Continental literature, but this is not available in English. His text-book on the clinical haematology of domestic animals should be known to every reader.* There is however a useful basis for further studies on normal standards in the work recorded by Fraser, and the contribution of Stewart and Holman in this issue is a welcome addition to the normal blood picture of the horse. Their paper is an example of the value of results being given in full by means of tables with complete details of the technique employed. Much of the literature is confusing because the methods used are not stated, making comparisons impossible.

When we have a real understanding of the normal variations that may occur in the blood of animals, the application of haematological methods to research problems and to routine diagnosis will be of immense value. The occasions on which this approach has been made already show its possibilities.

* Wirth, D. (1931.) Grundlagen einer Klinischen Hämatologie der Haustiere. Berlin: Urban and Schwarzenberg.

H.M. STATIONERY OFFICE PUBLICATIONS

The undermentioned have been published recently. Copies can be purchased through any bookseller, or directly from H.M. Stationery Office, at the following addresses—London: Adastral House, Kingsway, W.C.2, and 28, Abingdon Street, S.W.1; Cardiff: 1, St. Andrew's Crescent; Manchester: York Street; Edinburgh: 120, George Street.

	Price net s. d.	Post free s. d.
Draft Statutory Rules and Orders, 1940:—		
Poisons (Amendment) Rules, 1940	0 1	0 1½
Poisons List (Amendment) Order, 1940	0 1	0 1½
Command Papers:		
6163. *Medical Research Council*, Report for 1938-39	3 0	3 3
6174. *West India Royal Commission*, 1938-39 (Chairman, Rt. Hon. Lord Moyne, D.S.O.). Recommendations. February 16th, 1940 ...	0 6	0 7
6175. *Colonial Development and Welfare*, Statement of Policy on. February, 1940	0 2	0 2½

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PHARMACY AND POISONS ACT, 1933

Attention is drawn to the Notice published in the *London Gazette* of the Secretary of State's intention to make Rules amending the Poisons Rules, 1935, and an Order amending the Poisons List. Copies of the draft Rules and of the draft Order may be obtained (price 1d. net each) from H.M. Stationery Office, or through any bookseller. Any representations in regard to the amending Rules or Order should be made in writing addressed to the Under Secretary of State, Home Office, Whitehall, London, S.W.1, not later than March 19th, 1940.

CLINICAL COMMUNICATION

THE USE OF SODIUM IODIDE IN THE TREATMENT OF BOVINE ACTINOBACILLOSIS

L. GUY ANDERSON, B.V.SC., M.R.C.V.S.
and
R. R. BUGG, M.R.C.V.S.,
AYLESBURY

Subject.—An aged Shorthorn cow. It was reported that she had suddenly developed a swelling under the tongue.

Examination.—It was found that the frenum linguae was as large as a small coconut; the tongue was hard and protruding about 3 inches; the sub-maxillary, parotid and pharangeal regions were found to be very swollen and hard. The animal was in great distress, breathing being difficult and swallowing impossible.

Diagnosis.—A diagnosis of actinobacillosis was made.

Treatment.—Intravenous injection of sodium iodide —1 ounce in 12 ounces sterile water.

Course.—Twenty-four hours later the respirations were much easier and within 36 hours the animal was able to eat a bran mash. In eight days the swelling was all gone except for a small area in the anterior part of the sub-maxillary region, and the cow was eating well. A second injection was given and the animal made an uninterrupted recovery.

Discussion.—Some discussion on this mode of treatment of bovine actinobacillosis appeared in the *Veterinary Record* about a year ago, since when we have been using this method as a routine. Results appear to be sufficiently encouraging to be worth recording.

We use 1 ounce of sodium iodide in 12 ounces of sterile water, injected intravenously. This is repeated in about eight days, no other treatment being adopted.

In all, ten cases have been treated by this method (unfortunately many clients come into the surgery and ask for a bottle of "wooden tongue mixture"). Of these, one was a case that had been established for three months before we were consulted. Three injections of sodium iodide and the copious use of potassium iodide, *per os*, had no appreciable effect. Another case was that of a bullock. After the first injection it had improved to such an extent that it was decided to slaughter the beast, as it was so unmanageable. The remaining eight cases (including that of which a special description is given above) made quite uneventful and rapid recoveries.

The advantages of this method of treatment over the potassium iodide method are fairly obvious. Nothing is more wearisome to the farmer than indefinite drenching, especially of unmanageable animals which become progressively more resentful of the medicine. Improvement is much more rapid, and iodism less marked, which means that the loss of bodily condition is much less. It is also a point that this method of treatment cannot be sold "over the counter" by the vendors of quack remedies.

Mr. James G. Penny, Sauchie Poultry Farm, Crieff, has been appointed President of the Scottish National Poultry Council. Mr. Penny is one of the leaders in the poultry industry.

ABSTRACTS

[BIOLOGY OF THE SPLEEN IN MAMMALS. (Trans. title.) Steger, R. (1938.) *Deuts. tierärztl. Wschr.* **46.** 609-614.]

In this article the author gives a fairly comprehensive but somewhat scattered account of the general biology of the spleen of mammals. Storage and function of the spleen are considered with regard to the mechanical, productive, circulatory, and nervous aspects which, in part, are closely interrelated.

His main conclusions may be summarised as follows :

(1) Mechanical

(*a*) *Macroscopical Storage.*—The spleen is able to accumulate blood and to release it again into the circulation according to requirements. If the spleen is removed the normal response to movement (*i.e.*, the increase of the red cell number in the circulating blood) is abolished. This capacity differs, however, in the various species. The spleens of carnivores and horses are relatively larger and heavier, thus more fitted for the depot function, than those of ruminants and rodents. The decrease of the organ with age diminishes its adaptability. This depot function is related to the development of the trabecular and muscular tissue in the organ. The quantity of contractile elements present rises as follows : guinea-pig, rabbit, cattle, pig, sheep, cat, dog and horse. It is largest of all in racehorses. Changes of weight accompany the migration of certain fishes from fresh water to sea water and *vice versa*.

In the horse and dog the red cell content of the blood in the spleen may reach double that of the circulating blood. The extensive filter of the lymphatic system in the horse facilitates this concentration of the blood. The spleen of the dog and cat may store up to $\frac{1}{8}$th of the total blood volume. Blood not returned to the general circulation is destroyed in the spleen.

(*b*) *Microscopical Retention and Relation to Immunity.*—The reticulum surrounding the white pulp retains destroyed red and white corpuscles, cell fragments, formed pigments, etc., and by this filtration removes those elements of blood which may be transformed for further usage in the body. It is regarded as a principal organ in the formation of antibodies. The volume of the lymphatic part (white pulp) is in reciprocal proportion to that of the musculature, and increases rapidly in pathological conditions. It is supposed, however, that the reticulo-endothelial system is the most important factor in the combat against infections.

(2) Productive

The spleen of mammals produces red cells only in foetal life. Loss or destruction of blood may revive this faculty. It persists in fishes and some amphibia throughout life.

The breakdown products of the red cells are transformed into utilisable materials, the liberated iron is stored and partly released when needed by the bone marrow for blood regeneration. During life iron accumulates in the spleen. The iron-free residue is supplied to the liver which secretes it in the form of bilirubin.

White cells originate in the spleen throughout life. The white cell content in the splenic vein is double that of the splenic artery.

The spleen is said to inhibit oxidative metabolism, possibly by the production of a hormone. Stimulation of the spleen by X-ray irradiation and the injection of spleen extract accelerate blood coagulation ; the mechanism of this action is uncertain.

(3) Circulatory

The transitory storage of blood enables the spleen, together with the liver, to act as a regulatory mechanism for the circulation. The flow in the spleen is slower than in other abdominal organs. The blood in the spleen is, to some extent, separated from the general circulation. Inhaled CO_2, therefore, reaches this stored blood later than it does the blood circulating in other organs. This is a protective mechanism : splenectomised animals die more quickly from CO_2 poisoning than do normal controls.

On principle, the blood flow in the extended and in the contracted state of the organ must be differentiated. In the dilated condition, the red pulp consists of communicating cavities through which the blood passes to be emptied into the venus sinuses. In the contracted condition the meshwork collapses, and the blood may follow a closed path. Four possibilities are discussed which are realised in one or other of the species—horse, dog, pig, rabbit.

(*a*) Direct connection of arterial and venous capillaries.

(*b*) Completely unobstructed path through the red pulp.

(*c*) Direct open path from the fenestrated arterial end to the nearest venous sinus.

(*d*) By-path from a nodular arterial capillary to an adjacent venous sinus.

(4) Nervous

The spleen has an abundant autonomic nerve supply. Excitation of the sympathetic fibres causes contraction, while that of the parasympathetic fibres results in relaxation. If vagus and splanchnic are stimulated simultaneously the sympathetic effect predominates. The state of activity is influenced by higher centres. Sensations may be caused by stretch of receptors in ligaments when the organ fills copiously with blood.

C. W. O.

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[AIR SAC MITES (CYTODITES NUDUS) AS A CAUSE OF DISEASE IN POULTRY. (Trans. title.) Seyfarth, M. (1939.) *Deuts. tierärztl. Wschr.* **47.** 289-291.]

Seyfarth describes the results of a pathological and histological examination of a Rhode Island hen which died as the result of a heavy infestation with *Cytodites nudus*, the air-sac mite. After noting that the mite, which has a somewhat superficial resemblance to *Sarcoptes*, is generally referred to in the literature, especially text-books, as only occasionally causing death, the author reviews some twelve literature references in which fatal results of *Cytodites* infections have been described. The author's case was that of a well-nourished, two-year-old hen which suddenly died. At *post-mortem* examination the lungs were found to be bluish-red, oedematous and consolidated with several yellowish purulent foci, the size of millet seed, in the lung parenchyma. Smears from these foci, the trachea and air-sacs all showed numerous mites. Intestinal catarrh and inflammation of the oviduct were also observed. On histological examination it was found that the mites had penetrated into the larger air-sacs and into the depths of the lung parenchyma.

The interstitial connective tissue of the lung showed marked cellular infiltration with numerous eosinophiles amongst the inflammatory cells and the vessels were congested. The finer air passages were mostly filled with exudate containing desquamated epithelial cells and mites were present in the lumen of almost the whole bronchial tree. It was observed, on occasion, that a mite had bored through the delicate epithelial covering of a terminal air passage and penetrated the interstitial tissue. The author is of the opinion that *Cytodites nudus* cannot be considered as harmless, but as pathogenic, even in moderate numbers, since it produces fatal inflammatory lesions in the lungs.

J. N. O.

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[SULPHONAMIDE THERAPY OF EXPERIMENTAL PERITONITIS DUE TO E. COLI, B. PROTEUS, AND B. PYOCYANEUS. Cooper, F. B., Gross, P., Lewis, M. (1939.) *Proc. Soc. Exp. Biol. Med. N.Y.* **40**. 34-36 (1 tab.).]

The efficacy of sulphanilamide and of sulphapyridine in peritoneal infections of *E. coli*, *B. proteus*, and *B. pyocyaneus* in mice was tested. Lethal doses of each organism were administered to groups of mice which subsequently received 20 mg. of drug by mouth daily. Both drugs proved effective against peritonitis of *E. coli* and *B. proteus* origin, but ineffective against that caused by *B. pyocyaneus*.

D. D. O.

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[WHAT PROCEDURE SHOULD BE ADOPTED FOR DOUBLE DOSE INJECTIONS OF TUBERCULIN? (Trans. title.) Belle, G. (1938.) *Bull. Acad. vét. Fr.* **11**. 8.]

In a series of experiments on more than 800 cattle, the author made a study of the thermal reactions following the subcutaneous injection of a double dose of tuberculin with the object of determining the suitability of the procedure in common use for the single dose test, *i.e.*, the injection of the test dose of tuberculin at 10 p.m. and the recording of the temperatures at 6 a.m.

The appearance, intensity and duration of the temperatures were studied on 336 positive cases and the author concludes that a procedure similar to that used for the single dose test is equally suitable for the double dose test.

A. T.

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[THE CHEMISTRY OF CALCIUM IN TUBERCULOSIS. Sen, S. K. (1939.) *Ind. Med. Gaz.* **67**. 10.]

A number of observations supporting the administration of calcium as a treatment for tuberculosis, are recorded. Despite the fact that calcium has no specific effect, and that laboratory methods have failed to demonstrate favourable results, cases subjected to calcium therapy continue to improve and undoubtedly derive great benefit from the treatment.

D. D. O.

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[TUBERCULOSIS IN THE EMU. (Trans. title.) Fritzsche. (1939.) *Berl. tierärztl. Wschr.* **23** (June 9th). 361.]

During the summer of 1937 three young emus in the Zoo at Breslau developed conjunctivitis and went off their food. Avitaminosis A was suspected but therapy on these lines was without success and the birds became worse. It was decided to kill one of them and carry out an autopsy; this revealed generalised tuberculosis. Very large numbers of tubercle bacilli were found in smears from the conjunctival exudate and from the contents of the nasal sinus. The remaining birds were killed and similar lesions were found. Unusual sites for tuberculosis were the mucosa of the trachea and the serosa lining the air sacs.

E. G. W.

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[EFFECT OF ANOL AND DIHYDROTHEELIN ON MAMMOGENIC ACTIVITY OF PITUITARY GLAND OF RABBITS. Gomez, E. T., and Turner, C. W. (1939.) *Proc. Soc. Exp. Biol. Med.* **39**. 140-142. (1 tab. 4 refs.).]

Eight adult virgin female rabbits were given 0·1 mg. anol daily for 25 days; ten were given 20 rat units of dihydrotheelin daily for 25 days, and six were given 0·1 mg. anol and 20 rat units dihydrotheelin together daily for the same period. Twenty-four adult virgin females and ten adult male rabbits were maintained as controls, and all were slaughtered 24 hours after the last injection of the experimental animals. The pituitary glands from each group were combined, weighed, and assayed as units of mammogenic activity by the method of Lewis *et alia* (Endocrinology, 1938).

It was found that 12 to 13 mg. of pituitary tissue from the rabbits receiving anol established one unit of mammogen, whereas 20 mg. was required from those receiving dihydrotheelin, and as much as 60 to 80 mg. from controls; 7 to 7·5 mg. from rabbits receiving anol and dihydrotheelin together likewise equalled one mammogen unit.

It is concluded that both the substances under investigation definitely stimulate the production of mammogen by the pituitary gland. Of the two anol appears to be the more effective, and is capable of inducing growth in both the ducts and lobule alveolar systems of mammary glands. The combination of anol with dihydrotheelin is undoubtedly the most effective of all.

D. D. O.

TRICHINOSIS IN PIGS

Nature reports that an extensive survey of pigs in eastern Canada was carried out in 1937 and 1938 with the view of determining the incidence of *Trichinella spiralis*. All samples were selected at random and no selection was made, except that samples were examined only from hogs of which the district of origin was known (*Canadian J. Research*, **17**, Sect. D., 151, 1939).

"T. W. M. Cameron finds that of 2,000 hogs examined, only 15, or 0·75 per cent., were infected. In the United States during the same years the Bureau of Animal Industry reports in 1937 an infection of 3·4 per cent. where the hogs were fed on garbage and 0·32 per cent. where they were not fed on garbage, the corresponding figures for 1938 being 10·0 per cent. and 1·0 per cent. In Canada the feeding of hogs upon uncooked garbage is prohibited, and Cameron's figures agree closely with the corresponding statistics from the United States. There seems little doubt, therefore, that the majority of pigs infected with trichinosis in North America owe their infection to feeding upon raw garbage. Where garbage has been cooked before being served to the pigs, the incidence of the parasite falls to a level similar to that associated with clean food."

REVIEW

[**PATHOLOGICAL HISTOLOGY.** Ogilvie, Robertson F. (M.D., F.R.C.P. (Edin.), Lecturer in Pathology, University of Edinburgh.) (1940.) pp. 332. 220 Photomicrographs in colour by T. C. Dodds (F.R.P.S., F.I.B.P., Senior Technician, Pathology Department, University of Edinburgh.) E. & S. Livingstone, Edinburgh. £1 7s. 6d.]

As the author says in the preface, " this volume is designed to act as a companion to a standard text-book of pathology."

This design has been handsomely achieved. For the student reading for an examination in pathology the volume must provide a sound investment. Professor Murray Drennan in the foreword points out the value of the book to students of a large class where individual teaching is almost impossible. Examination of the text and illustrations proves this statement to be amply justified.

The 220 photomicrographs in colour form an outstanding feature of the book. The sections from which the illustrations have been prepared are typical, and the latter provide a clear impression of the features of each section illustrated in a manner that cannot be approached by monochrome illustrations. The vividness of these illustrations by the Finlay colour process emphasises the skill of Mr. Dodds, who was responsible for this side of the volume.

The text of the book follows the scheme adopted by many text-books of pathology, and the student can pursue his studies in both this book and a general text-book without inconvenience. The text is lucid and concise. The recent graduate, who is undertaking a post-graduate study of pathology, will find in this book the detail he requires of pathological processes.

The teacher and research worker will each in his own sphere derive considerable assistance from this volume, which is so logical in its plan that reference to points of particular detail can be made with great facility.

The earlier chapters are devoted to degeneration, inflammation and repair. These are followed by a chapter on specific inflammations. Tumours are described in two chapters. The later chapters describe special diseases of the various systems of the body. There is a good index.

The author and his technical collaborator have succeeded in adding to the text-books of pathology one that meets a real need in a manner that cannot fail to be a source of pride to them.

The only criticism that might be made of the volume is that the binding does not appear to be of a sufficiently substantial character to withstand the strain of the coloured plates, but it must be realised that a heavier binding would have added considerably to the cost of production.

SCIENCE IN WAR-TIME

It is announced that the British Association is arranging a conference on science in national and international aspects. The conference, which will be held at Reading on July 24th to 26th, will take the place of the ordinary annual meeting, which would in normal circumstances have been held at Newcastle.

IN PARLIAMENT

The following are among the questions and answers recorded in the House of Commons recently:—

Animal Feeding Stuffs

Mr. De la Bere asked the Minister of Food whether, in regard to wheat offals produced from the milling of flour from wheat at the port mills, he will confer with the chairman of the Animal Feeding Stuffs Board for the purposes of ensuring that these straight-run feeding stuffs thus produced shall not be allocated only to the large manufacturers, but shall be distributed to the corn merchants and dealers throughout all the provincial areas and counties in the country?

Mr. Morrison: The matter is at present under investition.

Mr. De la Bere: Does my right hon. Friend realise that this is a matter of the utmost importance? Does he further realise that one central and vital fact remains that equitable distribution is not taking place, and will he make enquiries as to what is taking place at the port mills as a result of processing wheat and why the wheat offals are not equitably distributed?

Mr. Ridley asked the Minister of Food whether he is aware that mixed meals are now being sold for pig feeding, the ingredients of which cannot be ascertained by the purchasers; and, as they are giving unsatisfactory results, will he cause careful inquiries to be made by his Department?

Mr. W. S. Morrison: Certain safeguards in the interests of the purchaser of a mixed meal are contained in the Fertilisers and Feeding Stuffs Act and in the Feeding Stuffs (Maximum Prices) Order, 1940. If the hon. Member will let me have particulars of the cases he refers to I will have inquiries made.

Lieut.-Colonel Acland-Troyte asked the Minister of Food whether he is aware that there is little, if any, improvement in the supply of animal feeding stuffs in the County of Devon; what action he proposes to take with regard to this matter, and when it may be expected that the supply will reach two-thirds of the normal as promised by him?

Mr. W. S. Morrison: The improvement in the supply of feeding stuffs in these areas has been retarded by shipping delays and internal transport difficulties due to the bad weather. Increased supplies have recently been made available and there will be a considerable improvement in the position as soon as the increased supplies reach the farmers through the usual channels of distribution. Though everything possible will be done to improve the position I am not able to add to my statement in the House on January 25th as to the percentage of normal supply which is likely to be available at ports in the immediate future and would add that the claims of dairy and beef cattle must continue to be preferred to those of pigs and poultry.

Colonel Burton: Is it not possible for my right hon. Friend to take this matter up, as in Suffolk we are absolutely without food for our pigs and poultry, and we are having to slaughter them?

Mr. Morrison: I am aware there have been difficulties in the distribution of feeding stuffs recently. If my hon. and gallant Friend will communicate his special difficulty to me, I will do what I can to meet it.

Viscountess Astor: Is not my right hon. Friend aware that it is a national scandal?

Mr. Ridley asked the Minister of Food whether he has considered the communications from Mr. F. Strawson, of Market Rasen, regarding the serious shortage of feeding stuffs and the consequent death of a large number of his livestock; and whether he has any statement to make?

Mr. W. S. Morrison: Yes, Sir. The difficulties of the farmer in question seem to have been due in part to the fact that the number of his livestock has been considerably increased as compared with last year and that he was unable to use the normal supplies of feeding stuffs on his farm owing to the heavy snowfall and the severe

frosts. When my Department heard of this case, the farmer's suppliers were communicated with and a certain quantity of feeding stuffs has been sent to him.

Mr. Ridley: Is the right hon. Gentleman aware that the Press publicity given to this case has caused deep anxiety over wide agricultural areas, and will he state what steps are being taken to give farmers more confidence in this matter?

Mr. Morrison: I am not responsible for everything that appears in the newspapers, but as soon as this case came to our notice we did what we could to help this man.

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Feeding Stuffs (Poultry)

Mr. Cassells asked the Minister of Food whether he is aware that in many Scottish areas wheat and maize, which normally approximate 40 per cent. of poultry rations, have been unobtainable for weeks past, with the result that many poultry keepers are refraining from hatching chicks; and what steps he is prepared to take to meet the position?

Mr. W. S. Morrison: If the hon. Member will let me have particulars of the cases to which he refers, I will have investigation made. I would remind him, however, that in view of the general shortage of purchased feeding stuffs and the necessity of giving preference to cattle and sheep, the quantities available for pigs and poultry are much below normal.

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Eggs

Mr. W. Roberts asked the Minister of Food whether he is aware that owing to the scarcity and high price of feeding stuffs, together with the plentiful supply of imported eggs purchased by his Department, British poultry farmers are only obtaining prices for their eggs far below the cost of production; and whether he proposes to take any further steps to prevent the wholesale bankruptcy of British poultry farmers?

Mr. W. S. Morrison: Both home-produced and imported eggs are in short supply at the present time owing to the recent cold weather. The prices of English eggs on the London market are double the average prices for the same date during the previous three years; the corresponding increase for Continental eggs is about 70 per cent.

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Poultry Stocks

Colonel Burton asked the Minister of Agriculture whether he is aware that it has been estimated, after careful calculation, that unless conditions in connection with feeding stuffs for poultry are remedied the country will be faced with an egg famine; and whether he is taking any steps to avert such a condition?

Sir R. Dorman-Smith: Although I have seen references to the matter, I am not aware of the estimates to which my hon. and gallant Friend refers. The Government recognise that those producers who have relied in the past upon purchased cereals and cereal products, and are unable to substitute food of their own growing, may have to face some reduction in their poultry stocks. A close watch is being kept on the production situation, but a reduction in egg supplies on the scale implied in my hon. and gallant Friend's Question is not expected.

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Milk

Miss Wilkinson asked the Minister of Food whether, in view of the need for increasing the supply of nutritive foods, he will forbid the use of milk for the manufacture of any non-edible articles?

Mr. W. S. Morrison: I understand that whole milk is not used for the manufacture of non-edible articles. Skim milk, of which a very small proportion is used in peace-time for producing certain manufactured articles, is not at present being used for non-edible products.

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Meat Control

Mr. Leonard asked the Minister of Food what representations he has received from food councils or committes regarding allocations of meat to traders which, when proved to be diseased, were still held to exhaust the traders' quota and fresh supplies refused; and what machinery exists to inspect meat suspected as being diseased?

Mr. W. S. Morrison: I have not received any representations of the kind referred to in the first part of the hon. Member's Question. Any such representations if made by the trader to the deputy or area meat agent or to the local food control committee will be immediately investigated. As for the second part of the Question, the usual peace-time machinery is available. In a memorandum which was recently issued by the Ministry of Health to local authorities in England and Wales emphasis is laid on the fact that I desire to have the benefit of the meat inspection services already provided by local authorities under the ordinary law. A similar memorandum is in preparation for issue by the Department of Health for Scotland to the Scottish local authorities.

Mr. Salt asked the Minister of Food whether, now that the number of animals slaughtered in the central abattoirs has so greatly increased, due to the closing of private slaughterhouses, this work is operating under satisfactory conditions; and how Birmingham and other large centres of population are affected?

Mr. W. S. Morrison: The answer to the first part of the Question is in the affirmative. As regards the second part of the Question, I can assure my hon. Friend that the supplies of home-killed meat in Birmingham and other large centres have been supplemented by imported meat whenever this has proved necessary to provide a reasonable quantity for the population concerned. Where temporary shortages have occurred during the recent severe weather these have been caused, not by the inadequacy of the slaughtering arrangements, but by the difficulties of moving livestock from the farms to the collecting centres or imported meat from the docks or cold stores to the distributing depots.

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Fat Stock Grading

Mr. Joel asked the Minister of Food the reasons for the issue by the Government to slaughterhouse managers and others of their officials, instructions that farmers must not be told what their cattle actually weigh; and whether, in cases where a farmer is dissatisfied with the ruling of the graders, he can be permitted to attend the slaughterhouse to see the animals weighed, as he is permitted to do in the case of pigs?

Mr. W. S. Morrison: Slaughterhouse managers have been warned that all information obtained in the course of their official duties must be treated as confidential and must not be disclosed except in accordance with instructions given by the Ministry.

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Grassland Ploughing

Colonel Burton asked the Minister of Agriculture what is the total sum which has been paid out to farmers who have ploughed up their land under the bonus scheme of £2 per acre?

Sir R. Dorman-Smith: Approximately 82,000 applications in England and Wales have been received covering approximately 1,000,000 acres. The number of applications paid and authorised for payment total 16,156. A further 3,000 are under examination. In the remaining cases the necessary certificates have not yet been received from the county war agricultural executive committees. The total amount paid or in process of payment to date in England and Wales is approximately £450,000.

Deer Forests (Pasturage)

Mr. R. Gibson asked the Secretary of State for Scotland what plans he has in view to provide for the summer pasturing of animals that were formerly carried by the permanent grass now being put under the plough; and what steps he proposes to take to make pasturage in deer forests available for this purpose?

Mr. Colville: Agricultural executive committees are giving attention to the question of securing additonal summer pasturage for cattle and sheep on lands not at present adequately used for such purposes. I have suggested to committees means of facilitating arrangements between owners of such lands and graziers. In cases where voluntary arrangements are not made formal directions may be issued in terms of the Defence Regulations.

Mr. Gibson: Will the right hon. Gentleman answer the second part of my Question which deals with pasturage in deer forests? What steps is he taking to make this available for the pasturing of cattle, previously pastured on grass which is now about to be ploughed up?

Mr. Colville: That was included in my answer. There are powers for dealing with land which is not at present adequately used. I am bearing that in mind.

Mr. Mathers: Is the right hon. Gentleman prepared to use those powers?

Mr. Colville: Yes, I have used them already.

Mr. Leslie asked the Secretary of State for Scotland what has been done by the Sutherland War Agricultural Committee to utilise the deer forests for grazing; and how many deer have been killed?

Mr. Colville: I understand that the committee have communicated with all owners of deer forests in the county in the subject of the utilisation of their forests for grazing cattle and sheep and that they have received a very favourable response to all inquiries. With regard to the second part of the Question, I have received returns for 11 forests where 375 hinds have been killed so far this winter. Two or three forests have yet to report.

SHORTAGE OF FOOD FOR POULTRY

Criticism of the Government's present policy in dealing with the poultry industry was made recently by Mr. Charles Crowther, director of the National Institute of Poultry Husbandry.

Addressing members of the Royal Society of Arts (reports *The Times*), he complained of chaotic maldistribution of feeding stuffs, and said that unless a more liberal treatment could be obtained for the poultry industry than had so far been extended no recourse to makeshift substitutes on the poultry farm, the general farm, or in the backyard could prevent a heavy contraction of activities and a probable egg famine before the year ended.

He said that before the war assurances were given in official quarters that the full co-operation of the industry would be required in war-time, and that adequate supplies of feeding stuffs, on which the industry was so greatly dependent, would be available. These assurances were renewed even in the early days of war and inspired for a time a feeling of optimism, which, however, was all too quickly and rudely shattered by the real facts of the situation.

Whatever the facts as to the total volume of supplies, the main causative factor of trouble, annoyance, and loss had been their unsatisfactory and grossly inequitable distribution. The favoured few at the one extreme had received almost normal supplies, while at the other extreme had been all too many who, through failure to get supplies, had been driven to give up their farms in despair, with loss of capital and their means of subsistence.

The first improvement to be secured, and that immediately, was an effective, systematic, and equitable rationing of available supplies of feeding stuffs to the merchants and organisations that supplied the farmer.

NOTES AND NEWS

The Editor will be glad to receive items of professional interest for inclusion in these columns.

Diary of Events

Mar. 11th.—Meeting of the Editorial Committee, N.V.M.A., at 36, Gordon Square, W.C.1, 4 p.m.
Mar. 14th.—Annual General Meeting of the South-Eastern Division, N.V.M.A., at Maidstone, 2.30 p.m.
Mar. 15th.—Annual General Meeting of the Mid-West Division, N.V.M.A., at Bristol, 2.30 p.m.
Mar. 18th.—R.C.V.S. Examinations at Reading.
April 1st.—R.C.V.S. Annual Fees due.
May 9th.—Last date for nominations, R.C.V.S. Council Election.
May 14th.—Provisional date for commencement of R.C.V.S. Animal Management Examination.
May 23rd.—Issue of R.C.V.S. Annual Report and Voting Papers.
May 30th.—Last date for receipt of R.C.V.S. Council Election Voting Papers.
June 6th.—**R.C.V.S. Annual General Meeting.** Victoria Veterinary Benevolent Fund Annual General Meeting.
June 27th.—R.C.V.S. Written Examinations begin.
July 3rd.—Provisional date for commencement of R.C.V.S. Oral and Practical Examinations.

* * * * *

Through an unfortunate mistake on the part of a new junior clerk, some members will have received two copies of the February 3rd issue of the *Veterinary Record*. Will members who have retained the duplicate be good enough to return it to the offices of the N.V.M.A., so that our supplies of this number can be maintained at the normal level.

* * * * *

National A.R.P. Animals Committee

Lectures at the Royal Veterinary College

"Mechanical Slaughtering Instruments, Their Use and Care; Destruction of Animals and Disposal of Animal Carcases" will be the subject of the sixth lecture to be given by Mr. H. E. Bywater, M.R.C.V.S., in the above series. It will take place in the Beaumont Lecture Theatre at the Royal Veterinary College on Tuesday next, at 2.30 p.m.

At last week's lecture, the Chief Executive Officer, Colonel Stordy, showed some lantern slides, which provided a most interesting feature which was much appreciated, illustrating methods of restraint in horses, and the effects of incendiary bombs and high explosive.

* * * * *

R.C.V.S. OBITUARY

Bate, John William, West Road, Weaverham, Cheshire. Graduated Edinburgh, May 28th, 1890. Died February 19th, 1940, aged 72 years.

Tucker, Frederick John, 87, Monmow Street, Monmouth. Graduated London, December 21st, 1888. Died February 10th, aged 71 years.

Mr. Tucker, who had been in failing health for some time, and Mrs. Tucker (who survives him), suffered a grievous loss when their only son, Capt. Reginald F. Tucker, of the Royal Engineers, was, as reported in the *Record* at the time, accidentally killed in France in a motor accident last September.

The late Mr. Tucker, who retired two years ago, practised at Monmouth for over 40 years. He was a Past Master of the Loyal Monmouth Lodge of Freemasons. The old Monmouthshire County Race Club,

which formerly held race meetings at Monmouth, had in him an active supporter, and he was the official hon. veterinary surgeon to the Club for many years. He was a life member of the Monmouthshire Show, an honour conferred upon him two years ago in recognition of the services he had rendered. In his younger days Mr. Tucker was a keen oarsman, and he always took an interest in regattas held on the Wye at Monmouth.

His death is much regretted by a large circle of friends. Mr. P. J. Mulcair, M.R.C.V.S., represented Mr. Tucker's fellow members of the profession at the interment, which took place at Monmouth Cemetery on February 14th.

* * * * *

SILAGE FOR BEGINNERS

Different Ways for Different Crops

Under the above headings, the *News Bulletin* of the Ministry of Agriculture states in a recent issue: "Many farmers will be making silage for the first time during the coming season. They may have none of the usual equipment used in the ensiling of green crops, and will probably wish to restrict the initial outlay of capital to the minimum compatible with making a palatable silage of good feeding value.

Most of the ordinary silage crops can be conserved, with good results, in pits, trenches and clamps. Among such crops may be mentioned oats and vetches, oats, vetches and beans (and/or peas), meadow grass lucerne, clovers, mixtures of clover and grasses, sugar beet tops, pea haulms (with or without the pods), etc.

Excavation of pits, clamps, etc., should be started before the heavy work of spring begins. Better quality silage with less wastage from moulding may be obtained if the pit is lined with concrete which gives permanence to the excavation. The use of molasses during filling is a sure method of greatly improving the quality and palatability of silage made in pits and clamps.

Silage can also be made in stacks, but it would be better to restrict this form of ensiling to the saving of hay crops that are in danger of being spoilt by the weather. In such cases a quick decision to ensile may have to be made and a stack may be begun with very little prior preparation. Ordinarily, however, the beginner has great difficulty in preventing excessive heating in silage stacks, and this may cause a pronounced reduction of feeding value. Further, wastage round the sides of a stack from mould action is liable to be very great.

Crops of High Feeding Value.—Finally, there are crops of high protein content and feeding value, such as young, leafy grass or an early cut of lucerne, that are particularly valuable in helping to supply both the maintenance and production requirements of dairy cows during winter. A concrete-lined pit might be used for preserving such crops, or, better still, some cheap form of constructional silo, such as a low-built, sectional wooden silo or the now well-known container with walls constructed of steel wire fencing in conjunction with sisal paper. Molasses should always be used to ensure the successful preservation of these valuable crops.

To sum up: Conserve the ordinary silage crops in pits and clamps. Save hay crops threatened with spoiling by rain in the form of stack silage. Reserve any purchased or home-made constructional silo for the preservation of specially valuable crops such as young grass. In this way, the newcomer to ensilage will be able to ensile cheaply and will, at the same time, help to obviate too big a call on the primary materials, such as wood and steel, that are necessary for silo-construction, but which, at the present time, may be urgently needed for other war-time purposes. Molasses, which should be used whenever possible, will be available in generous quantities.

* * * * *

MEAT SUPPLIES

During the past week there has been widespread complaint among meat retailers concerning the inadequacy of supplies of beef; also of the quality and price of mutton supplied at the Control Depots. Some improvement in the latter respect was evidenced towards the end of the week, and on Wednesday the Ministry of Food announced that Mr. W. S. Morrison, the Food Minister, was considering holding a meeting at an early date of the Chairmen of the butchers' allocating committees in the London area. Butchers generally, however, still contend that the whole meat distributing scheme, while it "looks all right on paper, does not work out in practice."

* * * * *

FOOT-AND-MOUTH DISEASE

The existence of foot-and-mouth disease was confirmed on Thursday of last week among sheep at Thorganby, Lincs. The area subject to restrictions in the movement of animals lies wholly in the County of Lincoln (Lindsey). A further outbreak among sheep was confirmed on Monday last. This occurred at Danbury, Essex, the area subject to restrictions lying wholly in Essex.

* * * * *

PARLIAMENTARY AND SCIENTIFIC COMMITTEE

It was announced at a recent meeting of the Parliamentary and Scientific Committee, held at the House of Commons, that the following bodies have now definitely agreed to support the new Committee:—

Association of Scientific Workers, Institute of Chemistry, British Association of Chemists, National Veterinary Medical Association (Dr. W. R. Wooldridge, a representative of the Association on the Committee, was present at the meeting), Institution of Structural Engineers, Institution of Marine Engineers, British Association for the Advancement of Science, Institution of Mechanical Engineers, Pharmaceutical Society of Great Britain, Institute of Fuel, Institute of Gas Engineers, Thames Barrage Association, Oil and Colour Chemists Association, Institution of the Rubber Industry, Association of Applied Biologists, Universities Federation for Animal Welfare.

It was also reported that the following Members of Parliament had agreed to become members of the Committee:—

Captain Plugge, Colonel Baldwin-Webb, Mr. Markham, Mr. Salt, Mr. Chorlton, Dr. Haden-Guest, Sir John Graham Kerr, Mr. R. R. Stokes, Sir Murray Sueter, Mr. David Adams, Mr. Henry Haslam, Sir Ernest Graham-Little, Major Procter, Mr. Kenneth Pickthorn, Mr. W. Higgs, Mr. R. H. Morgan, Mr. W. R. Duckworth, and Mr. I. C. Hannah.

It was agreed to give all possible support to affiliated scientific and technical bodies in ensuring fair treatment for scientific and technical workers in connection with military service, not only so far as the list of reserved occupations was concerned, but also with a view to ensuring that the special qualifications of scientific and technical workers enrolled in the fighting services should be properly appreciated and developed.

Discussion also took place on the report of the sub-committee which has been investigating the question of the nutritive value of bread, having regard to the importance of bread as an article of the people's diet in war-time.

* * * * *

ARMY VETERINARY SERVICE

London Gazette—War Office—Regular Army (Cavalry)

February 27th.—Vety. Maj. E. C. Bowes to be Vety. Lt.-Colonel (January 3rd).

Emergency Commission

Acting L./Corpl. A. M. Bain, Yeo. (T.A.) to be Lt. (February 28th).

POULTRY BREEDING IN SCOTLAND

The Department of Agriculture for Scotland announce that in addition to their Register of Accredited Poultry Breeding Stations they have approved a number of first-grade and second-grade stations in certain crofting districts in the counties of Argyll, Caithness, Inverness, Ross and Cromarty, Sutherland and Zetland for the supply of sittings of eggs and day-old chicks of pure breeds of utility poultry. First-grade stations comprise breeders who maintain blood-tested stock, of which all the females have been trap-nested for the pullet year. In the case of second-grade stations the trap-nesting of stock is not compulsory.

* * * * *

BAN ON NIGHT-PLOUGHING REMOVED

Thanks to the lighting concessions announced by the Ministry of Agriculture, farmers will now be able to plough in the black-out. The night-ploughing concession follows a case brought by the police at Holbeach, Lincolnshire, in which four tractor owners were summoned for permitting lights to be displayed on their tractors. The case was dismissed after the magistrates had been told that ploughing had been seriously held up. The ban on the movement of hay and other "inflammable" farm produce after dusk is removed. Vehicles conveying or hauling this produce must, however, conform with the general regulations.

* * * * *

ROYAL VETERINARY COLLEGE STUDENTS' ASSISTANCE FUND

The following amendments in the list of contributors published in the *Veterinary Record* on January 27th are notified: For "R. J. Hardy, £2 2s." read "Col. R. J. Stordy, £2 2s.," and for "Royal College of Veterinary Surgeons, £1" read "Dr. F. Bullock, £1." We regret that, in addition, owing to a misunderstanding, an item of two guineas contributed by the National Greyhound Racing Club was omitted from the list of contributors, although the sum itself was included in the total.

* * * * *

By the use of a cradle lowered from a derrick and hauled up by a farm tractor, four horses, that had been trapped for six days at the foot of a 100 ft. cliff near Milford Haven, were rescued recently.

* * * * *

A resolution urging that medical practitioners within the age limits of current proclamations should now be made liable for compulsory medical service with the Forces has been passed by the Central Medical War Committee. The resolution has been forwarded to the Minister of Health and the Minister of Labour and National Service.

* * * * *

VITAMIN K

"From being a curiosity having some obscure function connected with blood clotting in baby chicks, vitamin K has rapidly emerged as a crystalline compound or compounds whose structure is approximately known and has acquired a place in clinical medicine," states *The Lancet* in a leading article (December 2nd, 1939). "This advance has followed a now almost classic course for vitamins. First comes the observation that animals on a deficient diet show some symptoms which fail to yield to therapy with any known vitamin. The existence of a new dietary factor is thus recognised, and its chemical concentration goes hand in hand with the perfection of a biological technique for testing for it. As soon as a rich concentrate has been obtained physical and chemical tests are devised, and isolation, identification and synthesis are already in sight. If the concentrate is non-toxic clinical tests can be started and humanity can begin to benefit. To this last happy stage belong the papers by Dam and his colleagues, and by Kark and Lozner in this issue. Dam is the undisputed beginner of the story. In 1934, in the biochemical laboratory of the University of Copenhagen, he observed the occurrence of haemorrhages in baby chicks reared on artificial diets containing vitamins A and D and the vitamin-B complex, but otherwise deficient. The symptoms resembled those of scurvy, but did not respond to treatment with vitamin C. Here, therefore, seemed to be a deficiency of an unknown dietary factor.[1] In the next three years the subject was worked at in Copenhagen by Dam and his co-workers, and in the University of California by Almquist.

"A curative and preventive effect was first identified with cereal grains; then the curative substance was found to be fat-soluble and to be present in many other foodstuffs, including alfalfa meal (dried powdered lucerne). The name vitamin K was suggested[2] and has been retained. Dam's colleague Schønheyder detected that haemorrhagic tendency was due to a prolonged clotting time,[3] associated with a lack of prothrombin in the blood.[4] A method of measuring the clotting time, as depending on the concentration of prothrombin—the so-called prothrombin time—was devised with baby chicks. Like all biological methods this was at first rough, but was perfected by the co-operation of many workers till it was rapid and accurate. For measuring vitamin-K potency an animal unit of biological response was unfortunately established; it was called the Dam unit, and its use still persists, though it will inevitably have to disappear as all such units must.

"Dried alfalfa proved a suitable material from which to begin a chemical concentration of the vitamin, and both Dam and Almquist set to work on it.[5] This year the chemistry of vitamin K has greatly progressed; Dam and Karrer and their colleagues have been associated in the chemical investigation, and analyses and physical measurements have been published.[6] A group working with Doisy[7] reported the isolation from alfalfa of a vitamin K_1, resembling in properties the vitamin isolated by Dam and Karrer, and a vitamin K_2 which was obtained from putrified fish meal. Almquist and Klose[8] have found that pure synthetic phthiocol (2-methyl-3-hydroxy-1:4-naphthoquinone) has the same antihaemorrhagic activity as vitamin K. Fernholz and Ansbacher[9] suggest that the activity of phthiocol is due to contamination with a related substance, and Kuhn and co-workers[10] report similar activity in varying doses of a number of other naphthoquinone derivatives. It seems probable that, as with vitamin E, various substitutions can be made within the molecule which somewhat alter the activity without removing it altogether; the specificity within a narrow range of variation in composition is not hard and fast.

"When the concentraton of the active substance had reached a certain point, the door began to open to clinical and physiological investigatons. A number of other workers came into the field, though Dam was throughout a pioneer. It was noticed that chicks with prolonged clotting time were also anaemic,[11] and that there was a loss of coagulability in the blood of rats with a bile fistula.[12] Last year Dam and Glavind[13] published in these columns a series of observations on human cases. They found that the clotting power of the blood was normal in cases of thrombopenia, aplastic anaemia and haemophilia, but that it was impaired in five out of seven

1. Dam, H., *Nature*, 1934. 133. 909; Dam and Schonheyder, F., *Biochem. J.*, 1934. 28. 1355.
2. Dam, *Nature*, 1935. 135. 652; *Biochem. J.*, 1935. 29. 1273.
3. Schonheyder, *Nature*, 1935. 135. 653.
4. Dam, Schonheyder, and Tage-Hansen, E., *Biochem. J.*, 1936. 30. 1075.
5. Almquist, H. J., *J. Biol. Chem.*, 1936. 114. 241; *Ibid.* 115. 589; *Ibid.*, 1937. 117. 517; Dam and Lewis, L., *Biochem. J.*, 1937. 31. 17.
6. Dam, Geiger, A., Glavind, J., Karrer, P., Karrer, W., Rothschild, E., and Salomon, H., *Helv. chim. Acta*, 1939. 22. 310.
7. McKee, R. W., Binkley, S. B., MacCorquodale, D. W., Thayer, S. A., and Doisy, E. A., *J. Amer. chem. Soc.*, 1939. 61. 1295.
8. Almquist, H. J., and Klose, A. A., *Ibid.*, p. 1611.
9. Fernholz, E., and Ansbacher, S., *Science*, 1939. 90. 215.
10. Kuhn, R., Wallenfels, K., Wyegand, F., Moll, T., and Hepding, L., *Naturwissenschaften*, 1929. 27. 518.
11. Thayer, S. A., McKee, R. W., MacCorquodale, D. W., and Doisy, E. A., *Proc. Soc. exp. Biol.* N.Y., 1937. 37. 417.
12. Greaves, J. D., and Schmidt, C. L. A., *Ibid.*, p. 43.
13. Dam and Glavind, *Lancet*, 1938. 1. 720.

cases of obstructive jaundice; when three of these cases were given intramuscular injections of vitamin K the clotting time became normal in a few days. Further research along these lines with dogs showed that if a biliary fistula was established the animals developed a prolonged clotting time and a tendency to spontaneous bleeding even if the diet contained vitamin K.[14] It gradually became clear that vitamin K was a fat-soluble vitamin which could not be absorbed from the intestine in the absence of bile acids, and that symptoms of deficiency might arise either from this cause or through a lack of vitamin K in the diet. The effect of giving vitamin K and bile acids by mouth in human cases of biliary fistula and obstructive jaundice to prevent post-operative bleeding was found very satisfactory.[15] A deficiency is also reported to arise in certain cases of intestinal disorder where there is insufficient normal mucous membrane for absorption.[16] A different kind of case in which prolonged clotting time due to deficiency of prothrombin is present is described by Dam, Tage-Hansen and Plum on p. 1157. These are cases of jaundice, anaemia and haemorrhagic tendency in the newly born. Waddell and Guerry[17] have found the clotting time to be prolonged in babies with a tendency to spontaneous haemorrhage, and even in normal newborn babies, and that the clotting time is shortened by treatment with vitamin K. In Dam's cases the clotting time was sometimes enormously prolonged, but it usually tended to return to normal spontaneously if the child survived; one child was treated with vitamin K and bile salts with a rapid improvement.

"A simple deficiency of vitamin K, due to lack of the vitamin in the diet, has not seemed at all likely to occur in normal human beings. The paper by Kark and Lozner which we publish this week is therefore particularly interesting. It is true that the four patients described cannot be called normal, for they lived alone and provided themselves with such a scanty diet that, besides a prolonged prothrombin time, three developed scurvy and one pellagra. Jaundice was not present and therapy with vitamin K, without bile salts, sufficed to restore their clotting time to normal. These encouraging clinical results may yet be further extended."

14. Smith, H. P., Warner, E. D., Brinkhous, K. M., and Seegers, W. H., *J. exp. Med.*, 1938. 67. 911.
15. Stewart, J. D., *Ann. Surg.*, 1939. 109. 588; Scanlon, G. H., Brinkhous, Warner, Smith, and Flynn, J. E., *J. Amer. med. Ass.*, 1939. 112. 1898; Illingworth, C. F. W., *Lancet*, 1939. 1. 1031.
16. Clark, R. L., Dixon, C. F., Butt, H. R., and Snell, M. D., *Proc. Mayo Clin.*, 1939. 14. 407.
17. Waddell, W. W., Guerry, D., *J. Amer. med. Ass.*, 1939. 112. 2259.

CORRESPONDENCE

Letters to the Editor should reach the Office not later than by the first post on Tuesday morning for insertion in following Saturday's issue.

The views expressed in letters addressed to the Editor represent the personal view of the writer only and must not be taken as expressing the opinion or having received the approval of the N.V.M.A.

* * * * *

THE COLONIAL VETERINARY SERVICE

To the Editor of the Veterinary Record

Sir,—As a former member of the Editorial Committee, and one who many years ago assisted the committee in making editorial comment on the urgency of re-instituting the appointment of a Veterinary Adviser to the Colonial Office, to continue the good work of the late Mr. Eustace Montgomery, I would most heartily congratulate the National Veterinary Medical Association on the successful result of its protracted negotiations with the Colonial Office and the appointment of Mr. John Smith to fill this important office.

The selection of Mr. Smith is especially pleasing to me in that he is, or was, a Rhodesian; a fact which particularly qualifies him for his very responsible task, for Rhodesia has ever been a pioneer in the field of veterinary administration. My one regret, however, is that his is but a "part-time" and, apparently, temporary appointment, which will not enable him to do justice to his all-important office.

The recent announcement that the Government is to devote some five million pounds a year to encourage Colonial Development, and that Agricultural Research is to receive a large part of this sum, indicates that the Colonial Office has at last awakened to the value of the Colonies as a source of essential foodstuffs; and it is to be hoped that Pastoral Research, which is a necessary preliminary to agricultural development but which has hitherto been so sadly neglected, will receive generous recognition and support.

The Colonial Office might well follow the example of New Zealand, which has recently allocated £60,000 to be spent in prosecuting animal research. In his annual report for the year 1938-39, the Minister of Agriculture of that Dominion writes: "On the administrative side the most important innovation has been the setting-up of an entirely new division of the Department called the Animal Research Division, which came into being in March last. . . . The annual loss to farmers through disease among stock is a heavy one, and the Government is determined to take the fullest measures to alleviate the position." If this is necessary in a well-established country like New Zealand, how much more so is it if those vast areas of undeveloped country ravaged by innumerable unknown diseases of stock, which come under the aegis of the Colonial Office, are to be successfully exploited. To organise an efficient veterinary research system with a view to establishing a successful administrative service to serve the needs of these immense and widely disseminated Colonial Possessions, Protectorates and Mandated Territories, is by no means a "part-time job" and will require not only the foresight, energy and ability of Mr. John Smith, but the whole-hearted and generous support of the Imperial Government for many years to come.

It appears to me that the "National" should not be contented to "rest on its laurels," but should persist in its representations to the Colonial Office, stressing the need for intensive veterinary research and administraton in our Colonies, and emphasising the fact that the veterinary profession is ready and anxious to do its share if it be but given the opportunity and encouragement.

Yours faithfully,
Ll. E. W. Bevan.

Sirmoor Lodge,
Collington Rise,
Bexhill-on-Sea.
February 22nd, 1940.

* * * * *

APPOINTMENT OF VETERINARIAN AS TECHNICAL ADVISER ON MEAT INSPECTION SERVICES, TO THE MINISTRY OF FOOD.

To the Editor of the Veterinary Record

Sir,—While every member of the profession will applaud the appointment of a representative to the Ministry of Food as a hard-earned victory for the National Veterinary Medical Association, many members will be disappointed that the representative's sphere of influence is limited to meat inspection. Can we dare to hope that the official view of the scope of the term will be a liberal one?

Let those who had expected the authorities to grant us a wider field of activity within the Meat Control Scheme turn for consolation to Northern Ireland and meditate on the time when some of the spirit of confidence in the veterinary surgeon so evident in Parliament Building, Stormont, will enter Westminster or even St. Andrew's House.

Yours faithfully,
John C. Grant.

The North of Scotland College of Agriculture,
Veterinary Department,
Marischal College,
Aberdeen.
February 12th, 1940.

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